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ABSTRACT

This study is an attempt to determine the extent of telecommunications use by secondary school science teachers in the Queens borough of New York City. Science teachers in 39 middle schools and 32 high schools were surveyed in May, 1994, in the following categories of information: access to computers, hardware preference, hardware in use, access to the Internet, use of modems, and use of telecommunications and the Internet. A 27 percent response rate was obtained. Results indicate: low levels of access to computers (60 percent of respondents claimed no access); a desire to use computers in the classroom and a preference for the use of IBM compatible computers; a contradiction in hardware preference and hardware-in-use (32 percent of respondents used Macintosh computers, 24 percent used Apple IIe's, and 19 percent used IBM compatibles); limited access to the Internet (over 60 percent of respondents declared no access to telecommunications within the school); low levels of modem use (almost half reported they had never used a modem); and almost all teachers were unfamiliar with common techniques used on the Internet. The survey instrument is included. (LZ)

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A Survey of Telecommunications Use by Secondary School Science Teachers in New York City

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Paper Presented at the annual Meeting of the
National Association for Research in Science Teaching,
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Introduction

Since the advent of the Information Age, technology has been changing at an increasingly rapid pace. New hi-tech tools become available every day but it is really not known how rapidly these tools enter the classroom. This study was an attempt to determine the extent of telecommunications use by secondary school science teachers in the Queens district of New York City. According to data obtained from the Basic Education Data System (BEDS), New York state ranks 18th in the number of computers per student out of the 50 states and the District of Columbia. New York state also ranks 18th in the percentage of schools with modems, and 32nd in the percentage of schools with Local Area Networks (LAN) out of the 50 state and the District of Columbia (New York State Education Department, 1994).

Surveys of technology use among in-service teachers have found that teachers still spend very little time using telecommunications although this is definitely increasing (Chin, S. 1993). David McMullen and Daniel Keane (1992) carried out a survey of educational computing. With regard to hardware in-use, it was found that MS-DOS machines (IBM compatibles) outnumbered Apple and Macintosh computers in secondary schools by about three to one. Six middle schools out of twenty used modems. The most common use seemed to be electronic mail which was used in various projects such as keypals, exchanges of information. Other Internet techniques such as telnet, gopher, etc. were not mentioned. There were some schools which used commercial services. Free services

such as FrEdmail, the Heartland Freenet and PSINet were also mentioned. Very few schools were actually using telecommunications in the classroom. Four out of sixteen high schools were using modems. Only one school in used telecommunications in a project with other schools and three other schools used telecommunications to access libraries. According to McMullen and Kean (1992, p. 17)

> Generally telecommunications are not being used in the Tri-County schools. Only 16% of elementary schools, 30% of middle/junior high schools and 27% of secondary schools reported some form of telecommunications activity. Based upon the data reported, a question as to the extent of usage throughout the student population may be raised. It appeared that in most cases only a relative few teachers and students were involved with using telecommunications at each school.

The National Center for Education Statistics (NCES) conducted a survey of advanced telecommunications use in the nation's schools in the fall of 1994 (Heaviside, Malitz and Carpenter, 1995). The sample size included 1,380 public elementary and secondary schools. Among other things, it was found that 35 percent of public schools have access to the Internet although it was not clearly specified what was meant by "access." Approximately 3 percent of all instructional rooms were connected to the Internet. 14 percent of schools had access to wide area networks other than the Internet such as Compuserv, Prodigy, America Online.

In the 35 percent of schools which had Internet access e-mail is the most used Internet resource (91 percent). USENET newsgroups, Gopher, Archie, Veronica, etc. were available in slightly more than 60 percent of the schools. Graphical user interfaces such as Mosaic were in 21 percent of the schools with

access. All of the Internet resources were more accessible to teacher and administrators than to students. Of the 35 percent of schools with Internet access, more than 80 percent reported that teachers had access while 43 to 54 percent of the schools stated that students had access. 51 percent of the schools with Internet access had the point of access in one room while a much smaller percentage of schools had access in more than one room.

Of the 49 percent of schools which had access to the Internet or other wide area network services, only 3 percent stated that students used telecommunications to a large extent. 97 percent of the schools used modems to connect to the Internet or wide area networks and very few had T1, SLIP or PPP connections (Heaviside et al., 1994)

Many barriers to the use of telecommunications were listed in the NCES survey (Heaviside et al., 1994). Lack of funding was stated to be the major barrier, while lack of equipment, and not enough access points (in most cases phone lines) in the school, were other important barriers mentioned.

Schools with smaller enrollments were less likely to be connected to the Internet, i.e. 30 percent of small schools had Internet access while 58 percent of large schools had Internet access. Only 9 percent of the schools with Internet or wide area network access had full-time network adminstrators in the school. 51 percent of the schools had part-time network adminstrators.

Training was provided to teachers in 70 percent of the schools with access. Usually this training was supplied by the school

district and not the school. Training was supplied for 50 percent of the schools with access and for parents in 20 percent of the schools with access (Heaviside et al., 1994).

Methods

A survey was mailed in May 1994 to the science departments of thirty-nine middle schools and thirty-two high schools in the borough of Queens in New York City. One month was allowed for the return of the surveys. A twenty-seven percent response rate was obtained. In some cases every member of the science department responded while in others only certain members of the department responded.

The first twenty-seven questions on the survey were closed questions while the last three were open-ended. The data were analyzed using the Statistical Package for the Social Sciences (SPSS). A copy of the questionnaire is included in Appendix A.

Results

Most of the respondents to this survey were White males between the ages of 41 to 50 years who taught in middle or junior high schools. Nineteen schools out of seventy-one returned the surveys for a twenty seven per cent return rate.

The first important category of information measured by the survey was **access to computers**. About sixty per cent of the respondents claimed they did not have access to a computer where they teach.

Another important category of questions concerned the **hardware**

preferences of science teachers. Over eighty per cent of the respondents would like to have a computer in their own classroom. About forty per cent of the respondents preferred to use IBM compatible computers, twenty-five per cent preferred Macintosh computers, and five per cent wished to use Apple IIE computers. Almost twenty-five per cent of the teachers who responded did not wish to use any computer. Ninety-five per cent of the respondents claimed to like using computers.

Question three attempted to determine the type of **hardware-in-use** by secondary science teachers. About thirty-two percent of the respondents used Macintosh computers at school followed by Apple IIE's at twenty-four per cent, IBM compatibles at about nineteen per cent, and Apple IIGS's at fifteen per cent.

Access to the Internet was another important issue measured by the survey. Over sixty per cent of the respondents stated that they do not have access to telecommunications in their school. About forty five per cent of the teachers surveyed did have a computer and modem at home. Approximately twelve per cent of the respondents stated that they have direct access to the Internet. Almost ninety per cent of the respondents did not subscribe to a commercial network service. Only very few of the respondents stated that they had Internet access. About five percent of respondents connected through a local university and about seven per cent through other services.

An important tool necessary in telecommunications is the **modem**. Several questions yielded information on the use of modems

by science teachers. Almost half of the respondents had never used a modem or did not know what a modem was. About forty-three per cent of the respondents had a computer and modem at home. Most had learned how to use a modem from another person and this was followed by learning from a manual or by themselves. Twenty per cent of the users had used a modem more than five time and another twenty per cent reported using a modem more than fifty times. A large majority of the respondents did not know how many working modems there were in their school. About twelve per cent of the schools who responded had one modem while another twelve per cent had between five and ten modems. Almost twenty per cent of the respondents stated that between five to ten teachers used modems in their schools while most of the respondents did not know the answer to this question.

Finally, science teachers' **use of telecommunications and the Internet** was investigated. E-mail was by far the technique most familiar to the respondents and it was also the technique used the most. A few teachers had used telnet and muds but most were not using any Internet techniques. Only twenty per cent of the teacher's who responded to the survey had used computer bulletin boards (BBS's). Twenty-one per cent of the respondents stated that they had allowed their students to use telecommunications in school while only fifteen per cent of the respondents had ever used telecommunications during a lesson.

Very few responses were obtained to the open-ended questions. A common comment was that they did not know what the Internet was.

Most of the people who did answer knew that it was a network of computers and that it linked many different resources together. However, the true definition of the Internet as a network of networks which uses common TCP/IP protocols was not stated by any of the respondents. A few people had some serious misconceptions such as that the Internet is an "Electronic disk retrieval system."

Conclusions

Because of the low return rate it cannot be assumed that this sample is actually representative of the population of secondary science teachers in the borough of Queens. However, the characteristics of the largest number of respondents, White males, are the same as those of typical users of the Internet.

It is not known why most of the respondents were from middle schools. One possible reason for this could be time-pressures from external examinations on high school science teachers during this time at the end of the school year. It is also surprising that so few younger teachers took part in the survey.

If the data on **access to computers** are true, this could have important implications on funding priorities for technology projects in schools. It would be very difficult to justify spending large amounts of money to install sophisticated systems in a few schools while many others lack even one computer in each science classroom. This could also be an extremely important bottleneck in the integration of telecommunications into science learning.

Most of the respondents expressed the desire the have a

computer in their classroom but a substantial number did not. It could be important to determine why some teachers are still not convinced of the usefulness of computers in education. There was a contradiction in **hardware preferences** and **hardware in-use** in this sample. More teachers preferred to use IBM compatibles while Macintosh and Apple computers were much more common in classrooms. This could be caused by many reasons. Possibly the sample was not representative of the majority of science teachers. Another reason may be that many technology purchases are made in top-down fashion and the computers in a school might be a result of administrator preferences instead of the teachers. Technology purchases should be made after determining the needs, preferences, and goals of the students and teachers. It is this author's opinion that no one computer type is inherently superior to another in all educational situations, and that Apple and IBM compatible machines can both function well when used properly. It is encouraging that so many teachers claim to enjoy using computers since technology is assuming ever more importance in the world outside of school.

It was discouraging that so few teachers had access to the Internet. Especially since this sample could have greatly underestimated the number of teachers who may not have access to the Internet. The author suspects that many teachers who did not respond to the survey did so because they literally had nothing to say and no knowledge about the subject. A few teachers had accounts with commercial online services and a few were connected via local universities.

About forty percent of the respondents had computers and **modems** at home but almost half reported that they had never used a modem. Very few schools had computers with modems according to the replies received. If this critical piece of hardware is absent or if teachers do not know how to use it, computers become stand-alone boxes which are greatly limited in their capabilities. More teachers reported learning to use a modem through interaction with another person rather than through using a manual. This indicates that in-service workshops might be needed to assist teachers in learning to use this critical peive of hardware.

Almost all of the teachers were unfamiliar with common techniques used on **the Internet**. Electronic mail was most familiar to teachers and also the most used by science teachers. A very few teachers had used telnet but none indicated they had used techniques such as gopher, ftp, etc. More students were reported to have used telecommunications than had their teachers. It seems that in the schools that responded, very few science teachers had been aware of or using the Internet. Despite the small sample size, the results of this survey seem to agree with others conducted during this same time period. During the early 1990's there has been much publicity about the Internet and telecommunications but the use of the Internet has actually been a rare occurrence in many public schools.

A follow-up survey is planned for 1995 and this author thinks that teacher awareness will prove to be very different although access may not have improved much. Another important finding of

this study is the seeming lack of information about the use of telecommunications in science classrooms. More effort needs to be expended to obtain baseline data on telecommunications use. This is imperative since technology is changing at such a rapid pace. It may be a common misconception that because there is so much mention of the Internet in the media and use by business that it must be somehow be filtering down to students and teachers. According to this survey, the Internet is still a dream for many New York city schoolchildren.

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Appendix A

Telecommunications and Internet Survey

Please answer all questions by circling the answer/s you feel is/are most appropriate.

1) Do you have access to a computer in the classroom/s where you normally teach?

A) Yes
B) No

2) What type of computer do you prefer to use?

A) IBM compatible
B) Macintosh
C) Apple IIE
D) Apple IIGS
E) Other
F) None

3) What type of computer do you usually use at your school?

A) IBM compatible
B) Macintosh
C) Apple IIE
D) Apple IIGS
E) Other
F) None

4) Would you like to have a computer in your classroom?

A) Yes
B) No

5) Have you ever used a modem?

A) Yes
B) No
C) Don't know

6) How many times have you used a modem?

A) once
B) more than 5 times
C) more than 50 times
D) None

7) How many computers in your school have modems that work?

A) None
B) one

C) 5 to 10
D) greater than 10
E) Don't know

8) How many computers do you have with modems that do not work?

A) None
B) one
C) 5 to 10
D) greater than 10
E) don't know

9) How many teachers in your school use modems?

A) none
B) 1
C) 5 to 10
D) greater than 10
E) Don't know

10) Do you have direct access to Internet?

A) Yes
B) No
C) Don't know

11) If you do have access to the Internet, how do you connect?

A) Through a business computer
B) Through a goverment computer
C) Through a college or university computer
D) Through a computer at home
E) Other
F) Don't have access

12) Do you ever use computer bulletin boards (BBS's)?

A) Yes
B) No

13) Do you pay to subscribe to a computer network service such as Prodigy, Compuserv, or America Online?

A) Yes
B) No

14) Do you have a computer and modem at home?

A) Yes
B) No

15) Do you allow your students to use telecommunications in school?

A) Yes
b) No
C) Don't have access

16) Have you ever used telecommunications during a lesson?

A) Yes
B) No

17) Which of the following Internet techniques are you familiar with?

A) e-mail (electronic mail)
B) FTP (file transfer protocol)
C) telnet
D) gopher
E) mosaic
F) archie
G) WWW World Wide Web
H) computer conferencing
I) MUD (multi-user dimension)
J) synchronous talk or chat
K) None

18) How did you learn how to use your modem?

A) from a manual
B) from another human being
C) from a class
D) by myself
E) I didn't learn

19) Which Internet technique do you use the most?

A) e-mail
B) FTP
C) telnet
D) gopher
E) mosaic
F) archie
G) WWW
H) computer conferencing
I) MUD (multi-user dimension)
J) synchronous talk or chat
K) None

20) Which Internet technique do you use the least?

A) e-mail
B) FTP
C) telnet
D) gopher
E) mosaic
F) archie
G) WWW
H) computer conferencing
I) MUD (multi-user dimension)
J) synchronous talk or chat
K) I don't use any

21) What subject do you teach?

A) English
B) Mathematics
C) General Science
D) History
E) Geography
F) Social Studies
G) Earth Scien ce
H) Chemistry
I) Physics
J) Environmental Science
K) Other science
L) Art
M) Music
N) Physical Education
O) Other subject

22) What grade level do you teach?

A) High school
B) Middle school or junior high school

23) Do you like or dislike using computers?

A) I like computers.
B) I dislike computers.

Questions 24 to 26 are optional and you do not have to answer them:

24) What is your gender?

A) female
B) male

25) What is your ethnic group?

A) Black
B) Asian

C) Hispanic
D) Native American
E) White
F) Other (please write in space provided)

.....

26) What is your age?

A) 21-25
B) 26-30
C) 31-35
D) 36-40
E) 41-45
F) 46-50
G) 51-55
H) 56-60
I) 61-65
J) greater than 65 years

27) How do you think computers and telecommunication could best be introduced into your school?

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28) Please give a definition of the Internet and describe its possible implications for education.

Definition of the Internet -

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Implications of the Internet

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Please use the back of this sheet if you need more space.